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ABSTRACT

The instructional systems development (ISD) approach for the development and accomplishment of vocational training programs provides a methodology for gathering and analyzing job information, developing instructional materials in a variety of media, conducting instruction, and evaluating and improving the effectiveness of training programs. This approach is based on evidence that the tasks performed on a job can be identified and analyzed and that learning objectives and instructional strategies to achieve these objectives can be developed and structured so that instruction will be efficiently and effectively conducted. The procedural model and flowchart for ISD is comprised of five phases. Each phase--analyze, design, develop, implement, and control--is made up of a series of steps. The five phases and 19 steps are interrelated and form a closed-loop instructional system. Some of the steps can be conducted concurrently, while others must be done sequentially. ISD procedures are widely accepted and have been used by the military, government, and some companies for a number of years. The entire process has been documented and is available through government publications. The military has prepared a large selection of performance-based, criterion-referenced courses using ISD methodology that have been packaged for civilian applications. (YLB)

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PROCEDURES FOR TRADE AND INDUSTRIAL PROGRAM DEVELOPMENT

A Paper

Presented to

the Southeastern Trade and Industrial Education

Conference

Nashville, Tennessee

May 10, 1984

by

Clifton P. Campbell

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Introduction

Whether training entry level employees, retraining displaced workers or helping business and industry apply new techniques and technology, vocational training has the potential to be a powerful change agent. But before such potential can be fully realized, training programs must become accountable[1] for their relevance, effectiveness and efficiency.

After years of research and debate by leaders in the field, there is still no consensus on the best course of action for achieving program accountability. However, many experts see cause for optimism in an approach developed by agencies of the U.S. government, primarily the Department of Defense. This approach is called Instructional Systems Development (ISD). By definition, ISD is a deliberate and orderly process for planning, developing, implementing and evaluating training programs which ensures that trainees are taught the knowledge, skills and attitudes essential for successful job performance.

The accountability of vocational training programs is substantially increased when the principles and processes of ISD are used. This is because the derivative and iterative character of the methodology ensures, when its procedures are faithfully carried out, that instruction will meet job requirements.

Parts of this methodology, such as job analysis and objectives, are not unique to ISD and have been used by vocational trainers and educators for some

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[1] Accountability is essentially a form of the concept of management by objectives. Individuals and programs are evaluated to determine how well they are accomplishing the objectives for which they are responsible (the degree of success achieved). Accountability is a synonym for responsibility.

time. Their application was often fragmentary, however. The critical distinction with ISD is an emphasis on the inter-relationship between constituent parts rather than on selected parts themselves.

Overview

The ISD approach for the development and accomplishment of vocational training programs provides a methodology for gathering and analyzing job information, developing instructional materials in a variety of media, conducting instruction and evaluating and improving the effectiveness of training programs. This approach is based upon evidence that the tasks performed on a job can be identified and analyzed and that learning objectives and instructional strategies to achieve these objectives can be developed and structured so that instruction will be efficiently and effectively conducted. (CNTT-A10, 1976, p. 2-i)

The procedural model and flowchart for ISD is comprised of five phases: I) Analyze, II) Design, III) Develop, IV) Implement and V) Control. Figure 1 shows these phases, each of which is made up of a series of steps. Symbolically, this structure illustrates the recommended relationship of the five phases and nineteen procedural steps. It also provides a graphic portrayal of the inter-relationships between all the phases and steps which form a closed loop instructional system. Components of the model are necessarily depicted in a linear sequence. In practice, however, some of the steps can be conducted concurrently, while others must be done sequentially.

A descriptive digest, which covers the essentials of each phase of the ISD model, is provided under the following headings. These concise but comprehensive descriptions were prepared based on a review, analysis and synthesis of the documents used by the U.S. Government agencies as guides for applying ISD. The documents are cited in the reference list at the end of the paper.

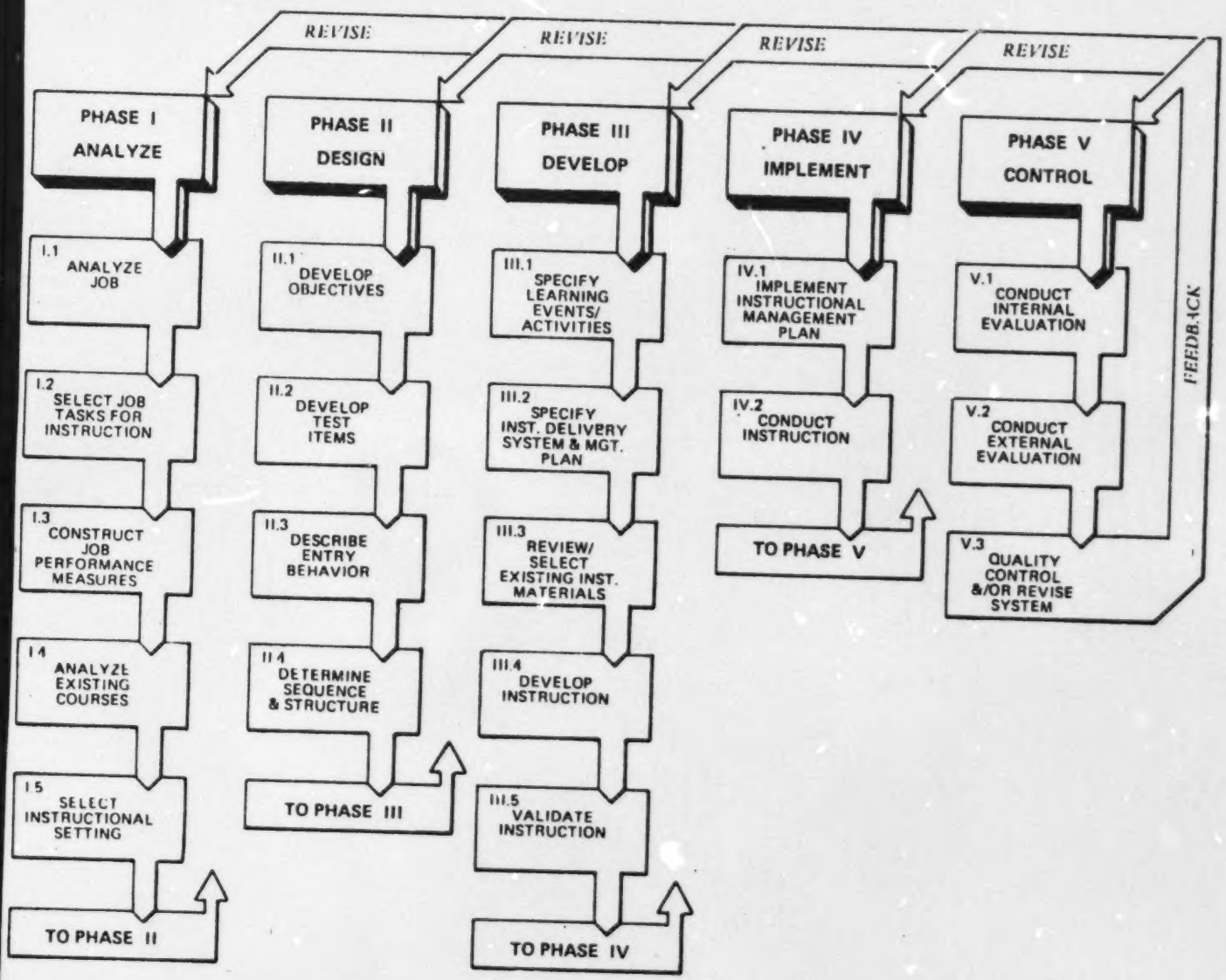

Figure 1

Procedural Model for Instructional Systems Development

Phase I, Analyze

The first procedural step in the ISD process is to establish what constitutes adequate job performance. Job analysis is the basic method for identifying and describing the tasks and elements of tasks which are necessary to perform a clearly defined, specific job. It can involve any or all of the techniques of questionnaire surveys, jury of experts, personnel interviews and observations at the work site, and reviewing job task lists from occupational surveys. Regardless of how well the following procedural steps are carried out, if job analysis data are not valid and reliable, the training program will fail to produce graduates who can perform successfully on the job. (NAVEDTRA 106A, Phase I, 1975, p. 1)

Some of the tasks identified will seldom be required on the job and only minimum job degradation would result if they were not performed. However, other tasks may be highly critical to successful job performance, and the complex nature of the task makes instruction essential. Economic, time, feasibility and other considerations require a decision as to which tasks are selected for instruction and which are not. Those selected become the basis of the training program; those rejected are not reconsidered until the external evaluation step in Phase V. Task selection criteria and information collected during the job analysis are used in making this important decision. (AFP 50-58, Vol. II, 1978, pp. 2-16 & 2-17)

Job performance measures are constructed for those tasks selected for instruction. These tests evaluate task proficiency under work conditions and standards. They are validated at the work site if resources and time permit. If not, the accuracy of a job performance measure must at least be verified by subject matter specialists. Job performance measures are a means of keeping training faithful to job requirements and serve as a connecting link between the tasks

and the learning objectives. Therefore, the behaviors, conditions and standards of the job performance measure resemble those of the actual task as closely as practical. Figure 2 shows a worksheet which is useful in preparing Job Performance Measures.

In addition to evaluating a job incumbent's task proficiency, job performance measures are used in formulating learning objectives (step II.1), in writing test items (step II.2) and in evaluating the performance of graduates on the job (step V.2). Because of their multiple uses, job performance measures are fundamental to the development and control of instruction. However, while worthwhile, considerable effort is involved in constructing these measures. (NAVEDTRA 110, 1978, p. 13)

In order to avoid unnecessary duplication of effort, existing course documentation and other available material should be examined. This effort may reveal that all or portions of the analysis and other phases have already been done by someone else.

As a final step in Phase I, the tasks selected for instruction are analyzed in order to identify the most appropriate instructional setting(s), e.g., classroom and/or shop instruction, on-the-job training, etc. (MIL-STD-1379A, 1976, p. 5) The optimal setting is the one that provides the necessary equipment, facilities and personnel as well as the most effective and efficient instruction. It should be noted, however, that settings are usually selected by higher authority and trade-offs, among competing alternatives, are frequently made based on resource availability and other constraints. See Figure 1 for a list of the steps (I.1 through I.5) described in this phase of the ISD model.

Phase II, Design

The first three steps in Phase I, generally referred to as front end

JOB PERFORMANCE MEASURE WORKSHEET

1. JOB TITLE _____ TASK NO. _____

2. TASK STATEMENT (Behavioral actions to be taken) _____

_____

_____

3. PERFORMANCE CONDITIONS (Identify those conditions under which the test is to be administered that would make a difference in performance)

A. SETTING: _____

B. ( ) ACTUAL EQUIPMENT (TASK OBJECT) UNDER ACTUAL WORK CONDITIONS

( ) ACTUAL EQUIPMENT (TASK OBJECT) UNDER SIMULATED WORK CONDITIONS

C. EQUIPMENT, SIMULATOR, MOCKUP, OR SIMULATED MATERIALS TO BE PROVIDED:

_____

D. PERSONNEL: _____

E. REFERENCES: _____

F. TOOLS: _____

G. SUPPORT MATERIALS: _____

H. SUPPORT EQUIPMENT: _____

I. TEST EQUIPMENT: _____

J. OTHER: _____

4. ATTAINMENT STANDARDS (a measure of the adequacy of performance)

A. ___% OF ALL CRITICAL SCORABLE CHARACTERISTICS/TASK ELEMENTS

B. ___% OF ALL NONCRITICAL SCORABLE CHARACTERISTICS/TASK ELEMENTS

C. TIME REQUIREMENT/LIMIT: _____

D. OTHER: _____

5. ADMINISTRATIVE INSTRUCTIONS

A. DIRECTIONS: _____

_____

_____

B. SCORING PROCEDURES: _____

_____

6. JOB PERFORMANCE MEASURE CHECKLIST (Label TASK ELEMENTS listed below with an (S) or (C) symbol as appropriate)

(S) SEQUENCE IS IMPORTANT. THIS STEP MUST BE PERFORMED ONLY AFTER THE PRECEDING STEP(S).

(C) CRITICAL STEP. FAILURE TO MEET STANDARDS FOR THIS ITEM CONSTITUTES FAILURE OF THE JOB PERFORMANCE MEASURE.

A. PROCESS: _____

_____

_____

TASK ELEMENTS	STANDARDS

B. PRODUCT:

SCORABLE CHARACTERISTICS	STANDARDS

analysis, focused primarily on job performance requirements. Phase II represents a shift in focus and step II.1, Develop Objectives, is the first step in designing training to meet job performance requirements. From this point on, instructional design and development will be carried out with respect to the objectives rather than the job tasks.

Learning objectives (both terminal and enabling) must realistically describe the knowledge and skills that are to be attained by the trainee. They provide a definitive statement of the behavioral actions, performance conditions and attainment standards which can be measured within the learning and testing setting.[2] Terminal learning objectives are formulated for all tasks selected for instruction. Job performance measures provide a basis for their development. (Application of a Systems, 1969, pp. 1 & 3)

Each terminal learning objective is subjected to a hierarchical analysis to derive intermediate (enabling) objectives. These enabling objectives provide the level of detail necessary to specify the behavioral elements and the skills and knowledge that mediate a terminal objective. (Vineberg & Joyner, 1980, p. xii) In some cases, the resultant enabling objectives will be the same as the elements of the task itself.

Learning objectives bridge the gap between performing a task under job conditions and learning how to perform that task in an instructional setting. Precisely developed learning objectives become the goals for training and serve as a control over the content and output of instruction. They define for the trainee, instructor, test writer and instructional materials developer exactly

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[2]The development of acceptable behaviorally stated performance objectives usually proves to be one of the most troublesome steps in ISD. Yet, more is known about this step than many of the others, and thus, more has been written about what should be done. What appears to be needed is management support for the time, personnel and other resources required to properly formulate objectives and the implementation of quality assurance measures.

what is required of them. (NAVEDTRA 106A, Phase II, 1975, p. 1) Figure 3 shows a worksheet which can serve as an aid in formulating and using learning objectives.

After all the learning objectives have been prepared, test items to measure trainee attainment are written. These test items are called criterion referenced measures because they test the required behavioral actions against the criteria for successful performance that were identified in the objectives[3]. With a criterion referenced measure, trainees are rated on their ability to attain the objectives. How others score on a test has no bearing on an individual's grade. (AFP 50-58, Vol. III, 1978, p. 1-2) The nature of a learning objective determines the type of criterion test item needed; thus, paper and pencil items are used to assess knowledge, performance items are used to evaluate physical/manual skills, and so on. Sufficient test items should be written for all learning objectives so that alternative forms, not just scrambled versions, of a test can be prepared for retesting. Where objectives are the same as the job requirements, tests may be similar or identical to the job performance measures constructed earlier. The grouping of test items into pre-tests, progress tests and a post-test is done in step II.4.

Once the test items have been written, those that were designed for lower level enabling objectives should be administered to a representative sample of the trainee population, as an entry level test, to measure entry level behavior. Entry level behavior includes the knowledge, skills and attitudes trainees possess at the time they report for instruction.

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[3]It is explicit in ISD that test items are written directly from learning objectives rather than from subject matter as is the practice in some other instructional approaches.

LEARNING OBJECTIVE WORKSHEET

PROGRAM/COURSE TITLE:			TASK NO.:	UNIT/BLOCK OF INSTRUCTION:
Basic Skills Training			2.5.1	Mathematics (Calculator Orientation)
FILL OUT ONE SECTION ONLY.	☐ TERMINAL	TERMINAL OBJECTIVE NO.: N/A	ENABLING OBJECTIVE NUMBERS THAT ARE SUPPORTIVE: N/A	
	☒ ENABLING	ENABLING OBJECTIVE NO.: EO 2.5.1.4	TERMINAL OBJECTIVE NUMBER SUPPORTED: TO 2.5.1	

BEHAVIORAL ACTION STATEMENT:

Multiply 10 decimal numbers, 2 to 4 digits long, by a one digit number and record the results of each calculation.

PERFORMANCE CONDITION(S):

Using a basic 4 function, hand-held calculator, given a sheet of multiplication problems and pencil.

ATTAINMENT STANDARD(S):

With 100% accuracy, within 3 minutes.

LEARNING CATEGORY:	LEARNING SUB-CATEGORY:
Physical/manual skills	Recalling procedures-positioning movement (includes both the cognitive & motor aspects of equipment set up & operation).

TEST ITEMS:

Form A		Form B	
107.2	X 7 = _____	983.5	X 3 = _____
961.0	X 9 = _____	96.37	X 5 = _____
2.773	X 8 = _____	752.9	X 8 = _____
91.50	X 6 = _____	61.74	X 6 = _____
7.16	X 4 = _____	537.3	X 7 = _____
540.3	X 3 = _____	4.6	X 9 = _____
87.29	X 9 = _____	61.83	X 5 = _____
4.165	X 6 = _____	835.7	X 7 = _____
4.8	X 5 = _____	7.384	X 8 = _____
528.9	X 7 = _____	63.7	X 7 = _____

Figure 3

(Curriculum Writer's Guide, 1980, p. 33) Estimates of trainee capabilities will be verified or adjusted according to test results. When the test shows that some of the enabling objectives, upon which test items are based, have already been mastered, those enabling objectives and their corresponding test items are deleted from the training program. Whenever the test indicates that trainees lack prerequisite knowledge and skills, additional learning objectives and test items must be developed to fill the gap between entry level assumptions and the true entry level required. No modifications are necessary when the test accurately measures the trainees' entry level behavior.[4] Entry level behavior may also be determined by testing the actual trainees before instruction begins. However, this leaves precious little time for making program adjustments.

The next procedural step is to determine and specify how the terminal objectives and their respective enabling objectives will be sequenced and structured. These decisions are made as much as possible on the basis of learning factors rather than administrative factors or past experience. However, given the inadequacy of knowledge about how different sequencing strategies affect learning and the difficulty of estimating transfer of learning, decisions must be based in part on judgment.

The following course of action is founded on various learning factors and sound judgment. First, the learning objectives are categorized as dependent, independent or supportive (those between which some transfer of learning occurs). The dependent objectives are then sequenced in accordance with the existing hierarchy of skills and knowledge so that prerequisite learning occurs first. Next, supporting objectives are placed as close to each other as possible without interfering with the

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[4]Results for each test item will probably show that some trainees already know the material while others do not. It is unlikely that everyone tested will either know all of the material or not know it. Therefore, in establishing an entry level for a group paced program, curriculum developers must use their best judgment in determining the exact level of instruction at which to begin.

dependent sequencing. Independent objectives are sequenced last in accordance with such principles as simple to complex, familiar to unfamiliar, the same order as performed on the job, or any other order that is practical. Identical learning objectives are deleted and those with identical actions are grouped together so that each is taught only once. (NAVEDTRA 110, 1978, pp. 96-98)

To the extent that seems reasonable, the sequenced learning objectives are grouped into units, blocks of instruction or other organized and manageable sets of objectives in the way they will be presented to trainees. Grouping is an arbitrary matter based on rational judgments regarding commonality of subject matter and anticipated transfer of learning. Other criteria for grouping objectives include: meaningful relationships, and a natural beginning and ending. (AFP 50-58, Vol. IV, 1978, p. 2-5)

Because test items measure specific learning objectives, they are structured at the same time as the learning objectives. This greatly facilitates the grouping of test items into pre-tests. progress tests and a post-test. The four steps in the design phase and their sequence are illustrated in Figure 1.

Phase III, Develop

The development phase begins by identifying the learning activities which must take place in order to produce the desired learning outcomes. In later steps, media will be selected and instructional materials developed to support these activities. The procedure for identifying learning activities is: 1) classify learning objectives according to the appropriate learning categories and sub-categories, 2) select the learning guidelines for each sub-category, and 3) convert each learning guideline into learning activities specific to the learning objective.

Table 1 shows four learning categories: mental skills, information/knowledge, physical/manual skills and attitude. Each of these categories is further divided into appropriate sub-categories so that more specific learning activities can be specified.

A learning objective is first classified into one of the categories and then assigned to a sub-category. (NAVEDTRA 106A, Phase III, 1975, p. 11) The learning objective must have complete action statements, conditions and standards in order to facilitate correct sub-category assignment. Once the sub-category has been determined, those learning guidelines necessary for optimum learning to take place are selected. Learning guidelines are statements which specify learning principles, events and activities. Some guidelines specify conditions of learning and principles which are appropriate for a variety of learning objectives and should be considered in identifying the learning activities. Four such guidelines are presented in Table 2 (specify learning objectives, guide trainee learning, provide practice and provide feedback). Other guidelines, however, are unique to each learning sub-category and require different instructional treatment. For example, information is not learned the same way as a physical skill. (NAVEDTRA 106A, Executive Summary, 1975, p. 66-69)

A list of learning guidelines, for each of the eleven learning sub-categories recorded in Table 1, is provided in NAVEDTRA 106A, Phase III, pages 35-70. From these lists, which are based in part on learning theory and in part on practical experience, the most appropriate guidelines are selected for each of the learning objectives according to its sub-category. The learning objective

Table 1

Learning Categories and Sub-Categories

Learning Categories	Learning Sub-Categories
1. Mental skills	1.1 Learning and using (applying) rules
	1.2 Classifying-recognizing patterns
	1.3 Identifying symbols
	1.4 Detecting-using the senses
	1.5 Making decisions
2. Information/knowledge	2.1 Recalling knowledge (information)
3. Physical/manual skills	3.1 Performing gross motor (mechanical) skills
	3.2 Steering and guiding-continuous movement
	3.3 Recalling procedures-positioning movement
	3.4 Communicating verbally
4. Attitude	4.1 Learning and exhibiting desired attitudes

Note. Parts of the table are adapted from NAVEDTRA 106A, Phase III, 1975.

Table 2

Learning Guidelines

Specify learning objectives. Trainees perform better when they understand what they are expected to learn. Therefore, learning objectives should be specified in instructional materials and/or stated at the beginning of a lesson.

Guide trainee learning. Most trainees require assistance when learning. They need examples of what to do and explanations of how to do it. Performance should be guided and/or prompted to make it as error free as possible since an error once made is likely to recur. Visual and verbal cues should be provided before and during practice to ensure correct performance.

Provide practice. People learn by doing. Therefore, learning activities should provide opportunities for practicing the knowledge and skills to be attained. Whenever possible trainees should perform repeatedly the task to be learned.

Provide feedback. Feedback is an integral part of practice. In order for practice to be as effective and efficient as possible, trainees need to have feedback relative to their performance. Feedback should be immediate and indicate what a trainee is doing right, what is wrong and how performance can be corrected or improved. Tests should be used as teaching tools by fairly testing the learning objectives and by providing reinforcement for correct answers or an explanation for mistakes.

action statement, conditions and standards developed in step II.1 and the test items from step II.2 are used, along with judgment, as the criterion for selection. The purpose then is to select those guidelines which best enable the trainee to attain the learning objective. Using the selected learning guidelines, the learning objectives and test items, it is possible to identify what the instructor or instructional materials must do in order to provide training as directly related to task performance as possible (e.g., demonstrate the use of a 4 function hand-held calculator to solve multiplication problems). (NAVEDTRA 110, 1978, p. 106) The learning guidelines and activities specified in this step are important in carrying out the following step as well as others in Phase III.

Two products become available when step III.2 is completed. The first is the specification of an instructional delivery system which provides the optimal combination of instructional methods, media and organizational system to accomplish the terminal objective.[5] However, since there is no single best method of teaching which applies to all learning situations or objectives, the instructional delivery system will normally include a combination of teaching methods, instructional media and a system of organizing students and instructors to accomplish an objective. The selection of one delivery system over another, therefore, is made on the basis of careful analysis of the instructional situation from several standpoints: 1) learning objectives, 2) course content, 3) characteristics of the trainee population, 4) instructional staff, 5) space, 6) equipment and facility constraints, 7) instructional materials, 8) time and 9) cost advantages or disadvantages of each delivery system. Consequently, the

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[5]The choosing of an optimal instructional delivery system for various learning objectives is a subtle and complex decision making task; something that cannot be fully proceduralized as evidenced by the limitations of existing techniques.

instructional delivery system must be compatible with the learning objectives selected in step II.1, the learning activities identified in step III.1 and any other significant inputs from previous steps in the model. (Braby, Henry, Parrish & Swope, 1978, pp. 7 & 8)

The second product of step III.2 is an instructional management plan. It consists of the policies and procedures used in organizing, controlling and evaluating the delivery of instruction. This plan indicates exactly how the training program is to be conducted, how the trainees are to be managed, when and where they will be tested, what the instructors and other support personnel are to do and how each of the many elements within the plan work together. Documents that are a part of the management plan specify the procedures to be used in scheduling, instructing, monitoring and evaluating both the trainees and instructors, and whatever else is needed to operate the training program. (NAVEDTRA 110, 1978, p. 189)

Developing instructional materials is an expensive activity. The costs are those of both time and money. Therefore, it is essential to search out and consider the suitability of existing items before committing resources to the development of new instructional materials. (AFM 50-2, 1979, p. 5-13) Candidate materials should be reviewed to determine their appropriateness to previously specified objectives, learning guidelines and activities, methods and media. Existing materials that are nearly, but not entirely, adequate may be adapted for use. (Handbook for Implementation , 1979, p. 11) It is evident that professional judgment is the dominant factor in the review and selection of existing instructional materials.

In step II.1, learning objectives were prepared for each task selected for instruction. In step III.1, learning guidelines and learning activities were specified. From step III.2, the media and methods of instruction have been

identified and from step III.3 suitable off-the-shelf instructional materials were assembled. At this point all the preceding analysis and planning will be utilized to produce the necessary additional instructional materials.[6]

The actual authoring process consists of writing or developing many different types of instructional materials: scripts, slide/tape presentations, video tapes, programmed texts, instructional packages, job performance aids, and so forth. Initially, these materials should include only the bare minimum of instruction, which will be augmented as needed for trainees to attain the learning objectives. This "lean strategy" helps prevent the inclusion of extraneous material which could be incorporated if an attempt were made to be comprehensive. Instructional materials are reviewed by a colleague as they become available. Then they are tried out on one representative learner at a time with revisions made as necessary. This progression assures the economies of minimal instruction and the correction of discrepancies. Quantitative information about the effectiveness of instruction is obtained through validation procedures which provide further opportunities for revision. (CNTT-A10, 1976, p. 3-86)

Validation procedures include both individual and group trials by selected members of the trainee population or representative learners. First, instructional materials are individually tried out on two to five trainees, revised and tried out again until consistent problems and errors are removed. Then group trials are conducted until it is proven that the trainees can attain the learning objectives as measured by criterion referenced tests. (AFP 50-58,

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[6]It is explicit in the ISD approach that learning objectives are prepared for every job task selected for instruction and that these learning objectives are the basis for the selection and development of all instructional materials used in the training program. Objectives are not derived from existing subject matter as is the practice in some other approaches.

Vol. I, 1978, p. 1-4) At this point instructional materials are ready for quantity reproduction and implementation. When instructional materials are put into use before validation trials are completed, continual revision with the actual trainees may be required. Figure 1 lists the five steps which make up the development phase.

Phase IV, Implement

The implementation of the instructional management plan developed in step III.2 is the terminal step in planning and preparation and occurs before trainees arrive and instruction begins. It is at this point that any discrepancies or deficiencies in the materials, procedures, tests and other necessary components of the total training program are identified and corrected. (NAVEDTRA 106A, Exec. Summary, 1975, p. 95)

It is also necessary at this time to make sure that the instructors and other key personnel are adequately trained in the techniques and procedures with which they are not familiar. The emphasis is on assuring that qualified people are at the right place at the right time, that they know what they are supposed to do, and they have the materials, equipment, facilities and other resources necessary to do it. (NAVEDTRA 106A, Phase IV & V, 1975, p. 1)

Complete training program capability, consisting of learning objectives, criterion referenced tests, instructional materials, instructional management plan, a trained staff, and adequate facilities, equipment, tools and supplies should now be available. What remains to be done is to conduct instruction in accordance with the procedures and documentation contained in the instructional management plan.

In addition to carrying out their other activities, instructors will keep records and collect data which are useful in evaluating the training program. Among the records kept are: test results and trainee performance for

each learning objective; instructor comments on trainees; time requirements for instruction and testing; and enrollment, attendance, attrition and scheduling data. A log is also maintained in which problems encountered with instructional materials, media and people associated with instruction as well as positive and negative incidents are noted as they arise. All editorial, procedural and content changes that were made must also be documented in order to facilitate a complete and accurate program evaluation.

At the completion of each training cycle, the collected information is made available as part of the internal evaluation in order to improve instruction for succeeding cycles. See Figure 1 where the two-step implementation phase is illustrated.

Phase V, Control

Despite the care taken in each procedural step while developing the training program, it is still necessary to determine the effectiveness of the program operating as a dynamic interrelated entity. The internal and external evaluation steps in this phase provide the needed information on program effectiveness. By careful analysis of this information, problems can be identified and appropriate adjustments made.[7]

Internal evaluation is based on information obtained within the school or training activity and is sometimes called a course review. It seeks to determine if instruction is providing trainees with the knowledge and skills necessary to attain the learning objectives. (NAVEDTRA 106A, Executive Summary, 1975, p. 104) The principal measure of instructional effectiveness is

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[7]To assure objectivity, the internal and external evaluation should be conducted by specialists who are not directly responsible for developing or conducting the training. The more independent and impartial the evaluator is, the more useful the data collected will tend to be.

the trainees' performance on criterion referenced progress tests and the post-test. Other measures include instructor performance, trainee and instructor opinions concerning instruction and testing, and the amount of time required to complete each learning objective (time on task).

Training records as well as the notes kept by instructors during the conduct of instruction (step IV.2) provide additional sources of valuable information. This is augmented by a check on the training facilities, equipment, tools and supplies to make sure they are adequate and appropriate, as well as an inspection of instructional materials and training aids to determine their quality and availability.

An examination of how the ISD process itself was carried out is also part of the internal evaluation. The purpose is to identify any procedural omissions and failures to use ISD products. Since the capabilities and performance of trainees and the manner in which instruction is conducted may change over time, internal evaluation is a continuous process.

The external evaluation is conducted to find out whether graduates are performing successfully on the job. It uses job performance as the standard to evaluate proficiency and the adequacy of the training program. In a sense this evaluation revalidates the job analysis, selection of tasks for instruction and job performance measure steps in Phase I.

External feedback is obtained by following recent graduates into the field either physically or by questionnaire. The most reliable, but costly, feedback is gained at the work site by actual observation of the graduates' performance and by interviewing both graduates and supervisors or by administering the job performance measures. Mailed questionnaires provide a valuable and less expensive means for conducting field evaluations. Two types are generally used, one is completed by graduates and the other by their immediate

supervisors. (AFP 50-58, Vol. V, 1978, p. 1-3)

The external evaluation should take place when the graduate has been on the job for about one to three months. This timing is important because it takes a while for the graduate to get oriented and acquire a feel for what the job is all about and for the graduate and supervisor to formulate judgments concerning job preparation and performance. If more than three months lapse before the graduate and supervisor are contacted, it becomes somewhat difficult to discriminate between knowledge and skills acquired in training and those acquired on the job. (NAVEDTRA 106A, Phase IV & V, 1975, p. 68) As with internal evaluation, external evaluation is an ongoing process which identifies problems and makes specific recommendations for revisions to instruction.

The final function in the ISD approach is that of maintaining quality control of the instructional program through the process of revision. Since a considerable amount of effort has gone into the design and development of an instructional program, and since revisions involve time, people and money, the decision about what to revise is based solely on the conclusive findings of internal and external evaluations (steps V.1 and V.2). (NAVEDTRA 106A, Phase IV & V, 1975, p. 88) Generally, revision means those changes and improvements made in the procedures, techniques and materials in the training program. The emphasis is usually on change of technique rather than of content, doctrine, or curriculum. (NAVEDTRA 110, 1978, p. 225)

The evaluation and quality control steps of Phase V complete the ISD feedback and interaction process, thereby forming the closed loop instructional system shown in Figure 1. Continual evaluation and quality control are necessary to ensure that instruction is efficiently and effectively conducted to meet job requirements.

Epilogue

Today, more than ever, vocational programs must be relevant, effective and efficient because they are being held accountable for providing quality training and producing "work-ready" graduates. Programs can no longer reflect one's "idea" of what should be taught and how the training should be organized and delivered. Reforms are needed and some vocational programs will have to change in fundamental ways if they are to help in revitalizing business and industry in America.

The search for an approach with increased likelihood for providing training adequate to meet job performance requirements has resulted in the advancement of ISD. This is because the iterative and derivative character of ISD methodology virtually assures that instruction will meet job requirements when its procedures are conscientiously carried out. The undertaking is demanding and time consuming, however. Consequently, ISD will be worth the cost and sizable effort only to the extent that it is implemented so as to realize its full potential.

The extent to which some will adhere to the ISD process and actually use its products in designing training is subject to question. In practice, steps are omitted at times and the close connection between components, that is essential to make the process truly derivative, is not maintained. Most important, the quality control and revision necessary to ensure job relevance generally do not occur. When this happens, ISD becomes a paper exercise. Efforts to implement ISD should therefore attend to the integrity of the model by guarding against omissions in the process and failure to use its various products.

As the main body of this text reveals, there is nothing really novel about Instructional Systems Development procedures. They are broadly accepted

and have been used by the military, government and some companies for a number of years. Nor is Systems Development a catchword to suggest something new; at most it is a process for doing something better -- better in deliberately attempting to be systematic, analytic and comprehensive.

Various U.S. Government agencies have spent millions in the development and refinement of ISD. The entire process has been documented and is available through the government publications listed in the references. In addition to publishing guides for applying ISD, the Navy and Air Force have prepared a large selection of performance based, criterion referenced courses using ISD methodology. These courses are "on-the-shelf" and available for use. They have been packaged and are distributed for civilian applications on a non-profit basis by the U.S. Naval Institute and the Aerospace Education Foundation.[8]

Additional military developed instructional materials are maintained in a special library at the National Center for Research in Vocational Education at the Ohio State University for use by visiting educators and trainers.

Course packages, available from the Naval Institute and Aerospace Education Foundation, contain public domain materials such as texts, study guides, workbooks, programmed units, and instructor guides. These packages also include the learning objectives and a summary of key elements including a list of equipment essential to the course, plans and parts lists for special devices used in demonstrations and laboratory experiments which form part of

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[8]For course catalogs contact U.S. Naval Institute, Annapolis, Maryland 21402, phone (301) 268-61[illegible], Aerospace Education Foundation, 1750 Pennsylvania Avenue, N.W., Washington, D.C. 20006, phone (202) 637-3370.

the system designs. All non-copyright audiovisual elements utilized in the presentation of a course are included in each package.

Every one of these course packages is the product of thousands of hours of highly thoughtful labor on the part of special teams, skilled in the techniques of ISD. Curriculum development of this type may cost in excess of $4000 per hour of instruction. However, the job can be done, through the adaptation of military materials, for a fraction of such costs. The point is that the use of such materials for a course or as resources to aid in developing a course should substantially reduce the cost of producing a performance based, criterion referenced program while facilitating the early availability of instructional materials.

It is important to avoid the possible misconception that these materials are a neatly wrapped package ready for purchase and immediate use by a secondary or post-secondary school population. They must, of course, be edited, refined or revised to meet local needs and the instructional setting in order to assure the desired results/outcomes.

Regardless of how good the course package may be, it is important that instructors participate in selecting, adapting or localizing the instructional materials for their trainees. Involvement will not only have a positive effect on an instructor's morale, but may even serve to "win over" those who are skeptical at the outset. Staff involvement will further assure that the materials are accepted and implemented because the instructor has a feeling of authorship and commitment to improving teaching and learning.

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